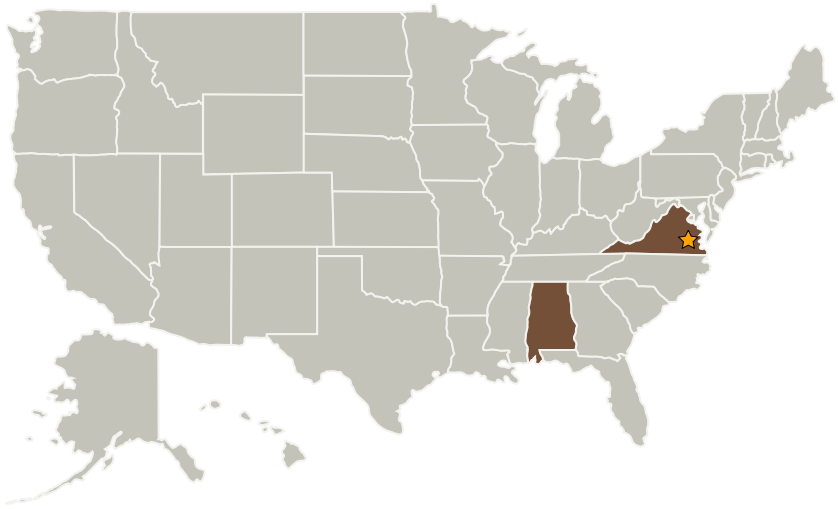
High Order Wavelet-Based Multiresolution Technology for Airframe Noise Prediction, Phase II

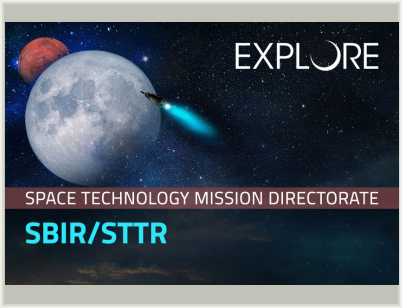
Completed Technology Project (2004 - 2006)

Project Introduction

We propose to develop a novel, high-accuracy, high-fidelity, multiresolution (MRES), wavelet-based framework for efficient prediction of airframe noise sources and acoustic propagation. In Phase I, 2D and 3D models of MRES methodology were developed. An acoustic analogy module based on Ffowcs Williams and Hawking technique was developed to accurately propagate the near-field acoustic signals to far field with minimal dissipation and dispersion. An innovative Runge-Kutta temporal update was developed to advance all grid levels independently. The feasibility and accuracy of the MRES technology was demonstrated by predicting noise sources and acoustic waves generated by vortex shedding. The Phase I results indicate that the proposed technology will provide up to two orders-of-magnitude reductions in CPU time over existing techniques. In Phase II, we propose to improve the 3D MRES software to handle multi-block, curvilinear, viscous and massively parallel applications. An efficient data structure will be developed and implemented to store and update the multiresolution data to improve the cost-saving factor. Unsteady turbulence models based on DES and PANS will be implemented to better resolve the sources of noise. The acoustic module will be improved to account for surface motions and quadrupole source terms. The developed modules will then be coupled to a large-scale CFD code to expand the application base of the technology. The technology will be demonstrated and validated using typical aeroacoustic applications such as Energy Efficient Transport (EET) airfoils and landing gear models.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Virginia

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.4 Aeroacoustics